Vol. 10 AUGUST, 1945 No. 8

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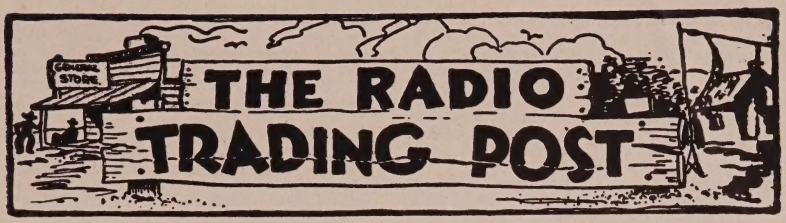


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**WANTED** — Battery charger, signal gen., portable phonograph and ampl. comb., and tubes 1A7, 1H5, 1N5, 35Z5, etc. For sale—VOM, tubes, etc. Royce Saxton's Radio Shop, R. 1, Pontiac, Illinois.

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**FOR SALE**—30w PA system, PP6L6 output 2 12" speakers, Turner mike and stand, brand new, also one hand mike, good working order, for $75.00. Academy Radio Service, 1901 Mott Ave., Far Rockaway, New York.

**FOR SALE**—Wirgin Geviette camera, has 4.5 lens in vario shutter, uses 127 film, 16 to the roll. Like new, with case, filters. First M.O. for $28.00 gets it. G. Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

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**FOR SALE**—American mod. EL, 2 button carbon mike, new; Shure crystal mod. 70, used; Turner dynamic, mod. 999, new; hi-impedance, Lektrophone contact mike with vol. control and mike plug, new; Signal electric drill, Jacobs chuck, ¼ inch capacity. John Archibald, 1722 Melville St., Bronx 60, N. Y.

**WANTED**—Radio test equipment; manuals, parts, etc. Cash or trade. What do you need. Can furnish printing. Shafer Radio Service, 246 N. Valley, Kansas City 2, Kansas.

**FOR SALE** — 2 Health machines in good working order. Want 25Z5 tubes. Louis A Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

**FOR SALE** — Clough-Brengle CRA Scope; OM modulated oscillator; and 79B Audio Oscillator. All in perfect condition, and seen very little use. Also includes instruction books, etc. Price $150.00 or best offer. F. Claude Moore, 1024 Henrietta St., Pekin, Ill.

(Continued on page 13)

# PUSH-PULL AMPLIFIERS AND PHASE INVERTERS*

A push-pull amplifier is one in which two small tubes are used instead of one large tube to accomplish the same stage gain, in order to take advantage of certain operating conditions for improved performance. Phase inverters are used in conjunction with push-pull amplifiers as a substitute for the push-pull input transformer. Since an analysis of the uses, advantages, and conditions for optimum performance of push-pull amplifiers aids the study of phase inversion applications, such data will be offered first.

### Triode Circuit

Fig. 1 shows a typical push-pull circuit, driven by a single triode. Any a-c voltage, of audio frequency, developed between points x and y on the primary of transformer $T_1$, will appear as an amplified voltage between points a and b on the secondary of that transformer. We assume, of course, that $T_1$ has a gain ratio, which is usually the case. However, there is one particular distinction between the voltages developed from $G_1$ to ground and $G_2$ to the same point. The a-f voltage developed between points a and b has a polarity relationship at all times. That is, point a is either positive or negative with respect to point b. The inclusion of point c does not alter this relationship, except to establish a common point for voltage measurement. Thus, if two volts were the total voltage between points a and b, the voltage from either p-p grid to ground would be one volt, but opposite in sign. It is important that this condition exist to ground, since ground is the common tie point for all voltages in a receiver.

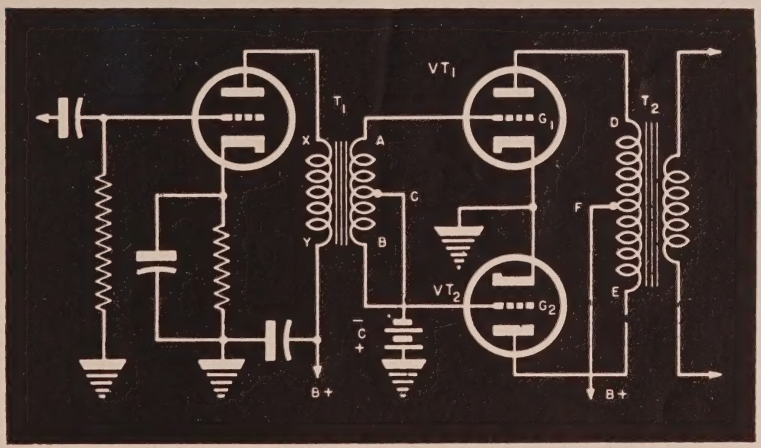



**Fig. 1. A typical push-pull output stage is shown here. Any voltage appearing between points A and B is opposite in sign, with point C as a voltage midpoint. This produces the push-pull action.**

* *By Edward Arthur in "Service" magazine.*

### Additive Voltages

A similar condition exists across the primary of the output transformer, $T_2$. The voltage between d and f represents the voltage between a and c amplified by the gain of the tube $VT_1$; the voltage across e and f represents the voltage across b and c amplified by $VT_2$. Since these voltages are additive, the output voltage is the sum of the individual voltages.

### Push-Pull Advantages

A similar voltage gain could be attained by using a single tube with twice the gain of either $VT_1$ or $VT_2$. However, there are certain advantages to be gained by the use of push-pull circuits.

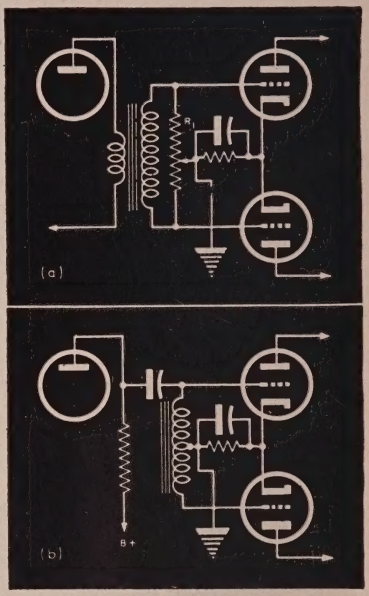
(1) Any hum voltage introduced through the B supply to the plates of the push-pull tubes, will cancel out, since the hum voltages across d and f, and e and f, are in opposition to each other. (2) D-c saturation in the core of the output transformer is avoided, because the magnetic fields created by d-c are also in opposition. This is evident from the fact that the outside terminals, d and e, are both negative (d-c) with respect to point f, the center tap. (3) Feedback or oscillation is minimized, since feedback voltages cannot be fed back through the B supply, (point f is a balance point for any voltages developed in the output circuit).

### Low Harmonic Output

The most important advantage of the push-pull amplifier lies in its low second harmonic output. Reference to any tube data book will show that the maximum rated output of a tube is limited by its harmonic distortion. The greater part of this distortion is of the second order. When the second harmonic approaches 5%, the maximum output has been reached for efficient operation. Push-pull amplification cancels this second harmonic distortion, as well as all even order harmonics, thereby permitting operation at either higher power levels, or at reduced distortion factors.

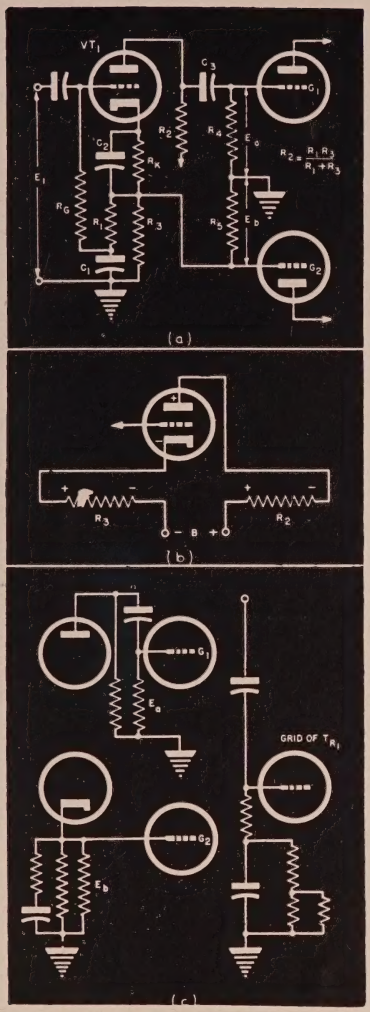
### 6L6 Amplifier

Let us take the 6L6 as an amplifier application example. As a class A amplifier, with 250 volts on the plate, a single tube will deliver 6.5 watts, at 10% distortion. Two tubes in push pull will deliver 14.5 watts at 2% distortion; more output at lower distortion. Increasing the plate voltage to 270 on the single tube has no appreciable effect on either the distortion or the power output. However for the 6L6 in push pull, the output increases to 18 watts, at 2% distortion.




**Figs. 2a and b. Fig. 2a shows a method of substituting an interstage for a push-pull transformer. In 2b, an open primary in a push-pull transformer is replaced by an RC network.**

Second harmonic distortion, created within the tube, is eliminated because the voltages are built up in each half of the output transformer, in opposition to each other. This is true for all even order harmonics.




**Figs. 3a, b, and c. Fig. 3a shows a typical inverter circuit. In b we see how the push-pull voltages are developed. In c, the load impedances for the push-pull grids are separated, for ease in determining balanced values.**

Now, to initiate push-pull action in the input of the amplifier, some method of input to the two grids must be used to simultaneously supply both grids with equal potentials of opposite sign, with reference to ground. That is, the input voltages must be 180° out of phase.

### Push-Pull Methods

Fig. 2 shows two methods of accomplishing a push-pull action without the use of a standard push-pull input transformer. In Fig. 2a, a standard interstage transformer is used. The formula used to determine the proper load resistance, $R_1$, for the plate of the driver is:

$$R_1 = R_p N^2, \text{ where}$$

$R_1$ = resistance in ohms

$N^2$ = square of the transformer ratio

$R_p$ = load impedance required for plate of previous stage

The potentiometer arm is then used to balance the input voltages to the push-pull grids so that they are equal.

Where the primary of a transformer is open, the circuit shown in Fig. 2b may be used. It should be noted that the stage gain will be reduced by the transformer ratio, since in this circuit arrangement the transformer gain can never exceed 1:1. In addition, the plate voltage on the driver tube will be materially reduced, due to the added resistance in the plate circuit, which will further reduce the audio gain.

### Phase Inverter Circuits

The purpose of the phase inverter is to duplicate the performance of the push-pull input transformer. This may be done with or without the use of an additional tube. Since most input transformers are also sources of gain, it becomes necessary to use an additional tube where increased stage gain is desirable. With the development of the twin triod, the addition of another tube has been simplified. The only additional components required are some resistors and condensers.

### Out-of-Phase Voltages

To develop out-of-phase voltages for supply to the push-pull grids, either one or two tubes may be used, Fig. 3. In Fig. 3a, a single tube is used. Here, $E_1$ represents the a-f voltage applied to the grid of the driver tube, and $E_a$ and $E_b$ represent two voltages, equal in magnitude, but opposite in phase. The bias voltage for the grid of $VT_1$ is developed across $R_k$. Since any resistor in the cathode circuit is a continuation of the plate circuit, a tube may be represented, as shown in Fig. 3b. If the supply source is considered as the ground point, the cathode end of $R_3$ has a positive potential with relation to ground, and the plate end of $R_2$ has a negative potential with relation to the same point. Thus, these two points are out of phase. Increases or decreases in the plate-cathode current will affect both $R_2$ and $R_3$ to the same degree, since they are effectively in series. If their numerical value is the same, the voltages across them will be identical. The grid of the driver tube must be returned to ground, yet isolated from the feed end of $R_3$ which is connected to one of the p-p grids. The isolation circuit consisting of $R_1$ and $C_1$, is used for this purpose. However, this introduces a shunt circuit across $R_3$. Therefore $R_2$ must be equal to $R_3$ in parallel with $R_1$, which is expressed by the formula,

$$R_2 = R_1 \times R_3/R_1 + R_3.$$

$C_1$ must be large enough to prevent low-frequency attenuation, in much the same manner as a tone control. Capacitor $C_1$ here affects the whole system, since it is in series with the input circuit; the load reactance of this circuit will vary with frequency, decreasing as the frequency decreases. In much the same manner, the shunting effect of $R_1$ in series with $C_1$ across $R_3$ will decrease. This will tend to unbalance the voltages applied to the push-pull grids, and result in increased distortion. To minimize its effect, $C_1$ should be large enough at the lowest audio frequency being used, so that it does not represent any appreciable portion of the total resistance of the circuit. Fig. 3c shows the load relations of the various grid circuits.

### Increasing Stage Gain

Fig. 4 shows a variation of this principle. Two tubes are used in this circuit to produce greater stage gain.

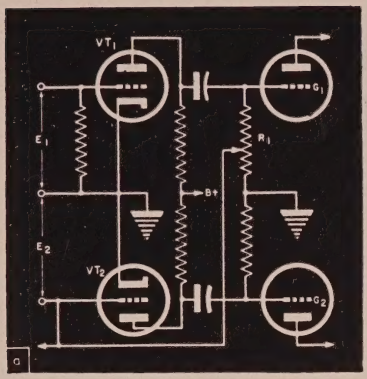
The input voltage is applied to $VT_1$, amplified, and then applied to the p-p grid, $G_1$. A portion of this voltage developed across $R_1$ is then applied to the grid of $VT_2$. However, the voltage across $R_1$ is out of phase with the voltage applied to the grid of $VT_1$. Therefore, the voltage applied to the p-p grid, $G_2$, will be out of phase with that applied to the p-p grid, $G_1$. For balance, $E_2$ must equal $E_1$.

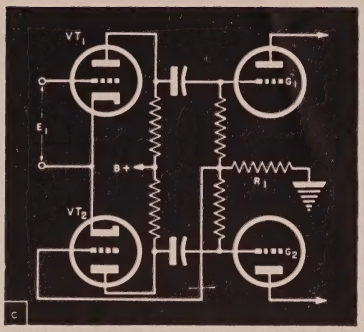
### Inverter Circuits

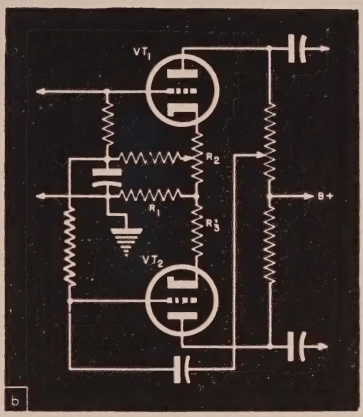
Figs. 4b, c, and d show inverter circuits used with inverse feedback. Feedback, in inverters, is used to prevent unbalance and frequency distortion. If, in Fig. 4a, either $VT_1$ or $VT_2$ were to require replacement, some unbalance would possibly result if the new tube did not have the same gain as the old one. Therefore, $R_1$ would have to be adjusted every time the tubes were replaced. In addition, if the tubes did not age equally, the same condition would result. To reduce this effect, inverse feedback is used. In addition, any non-uniformity in frequency response is also equalized.

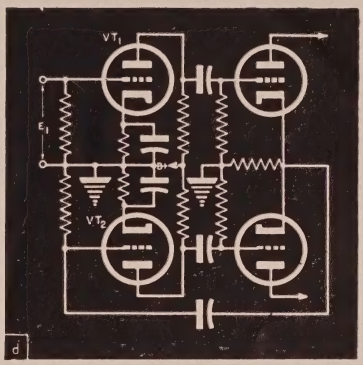
Fig. 4b shows a phase inverter using negative feedback. Here, a portion of the voltage developed in the output of $VT_1$ is applied to the grid of $VT_2$ in very much the same manner as in Fig. 4a. However, any unbalance in the two circuits produces an a-c voltage of audio frequency across $R_1$, which is common to both tubes. This feedback voltage is thereby applied to the grids of both tubes, through the cathode resistor network. $R_2$ and $R_3$ apply additional feedback to the circuit, but may be bypassed if feedback is only desired for balancing purposes.

Fig. 4c shows another method of using circuit unbalance for self com-




**Figs. 4a, b, c, and d. Four methods of inversion are shown here. Fig. 4a will give inversion with stage gain. In b, c, d, appear inverter circuits utilizing negative feedback for equalization of frequency response.**

pensation. Here, any unbalance in the developed voltages driving $G_1$ and $G_2$ is reflected as a voltage drop across $R_1$. This voltage is then used to feed the grid of the inverter tube, $VT_2$, which tends to reduce this unbalance. If the inverter tube is a high-gain amplifier, the unbalance may be reduced to very low levels.

Fig. 4d is similar to Fig. 4c, except that the cathode circuit of the output stage is used to provide the unbalanced feedback voltage. Note its similarity to the circuit in Fig. 4b insofar as feedback is concerned.

The use of feedback in association with inverter circuits is recommended, since it results in improved audio quality. Quite a few set manufacturers incorporated this feature in their prewar models, and will probably include it in their postwar receivers.

# POWER TRANSFORMER SERVICING*

Many factors may contribute to power transformer breakdowns. Some of these are . . . defective construction, high temperatures or humidity, excessive line voltages or surges, allied component defects, or any combination of these effects. Higher than normal temperatures may be caused by overloading, insufficient ventilation, high ambient temperature or power-line troubles such as low frequency or bad wave-form. When transformers are not properly treated with insulating materials they are subject to various forms of deterioration due to moisture, which prompts insulation breakdown. Excessive heating can be caused by the gradual breakdown of some unsuspected component such as a filter condenser which gradually draws more and more leakage current. Since exact replacements are still unavailable, servicing of many receivers has presented many problems. In some instances transformer repair is possible. In other instances an approximate-exact replacement must be used. Such installations involve several circuit changes.

### Replacing 6.3-Volt Transformers

In Fig. 1a, we have a conventional 6.3-volt transformer setup that may be altered. The alteration is shown in Fig. 1b. Here we have a method of adapting an old-type transformer with three-filament windings for replacement. In this modified circuit, the old-type transformer originally had a heavy 2.5-volt winding, standard rectifier 5-volt winding and a light 5-volt winding for power tubes. The modified unit can supply 6.3 volts by combining the 2.5-volt and the 5-volt power-tube windings in the proper direction and adjusting the voltage by a series resistor of approximately 1 ohm. If a further substitution of a heater-type rectifier tube is warranted, the substituted unit need have only a 2.5- and a single 5-volt winding. Types 6X5 or 6ZY5G can be used on the same 6.3-volt winding as the other tubes, provided that their output is sufficient for the required load.

### Excessive Voltage Control

In Fig. 2a, we have a case where an approximate-exact replacement transformer was used. The replacement was satisfactory except that the B-voltage delivered was excessive. To reduce this voltage it is necessary to insert a pair of resistors, preferably 10-watt wire-wound (5 watters may do) directly in the plate leads to the rectifier. A larger single resistor in the common high voltage lead would also be satisfactory. Where the rectifier is found to heat up faster than the load, the voltage should be reduced further to protect the first filter section. This precaution becomes a necessity when a filament-type rectifier is used with heater-type power tubes and very little safety factor has been allowed for dry electrolytic filters.

When an oversize replacement transformer must be used, and the available transformer gives excessive voltages on all windings, a primary resistor or choke should be used as in Fig. 2b. For most applications, a 25-watt adjustable resistor of 20 to 50 ohms will be most convenient. In an emergency a small coil of wire, with or without iron may be used as a choke.

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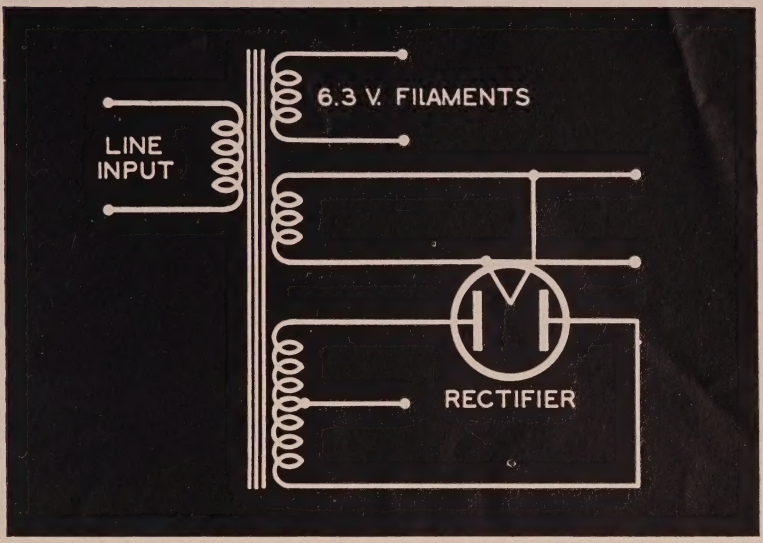
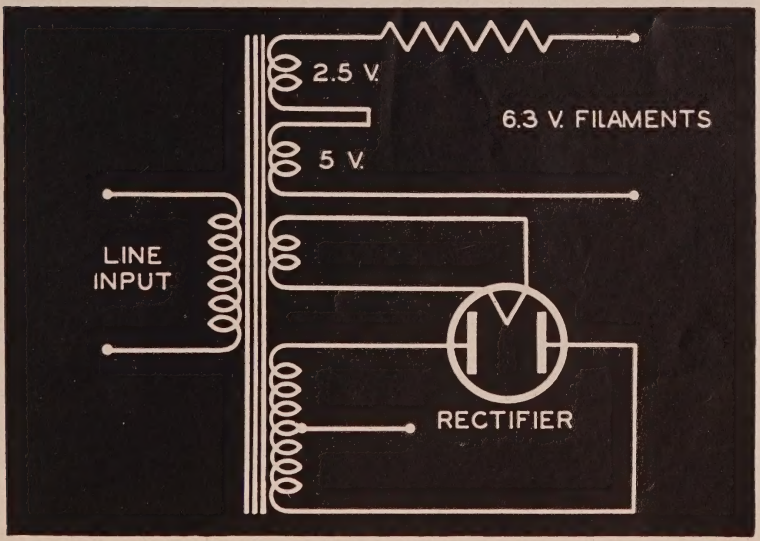
* *By Arnold D. Peters in "Service" magazine.*




Figs. 1a (above) and 1b (below). In a we have a standard 6.3-volt transformer installation. How to use a 2.5 and 5-volt transformer to secure 6.3 volts is shown in b. The two windings are connected in series aiding to provide the required voltage.



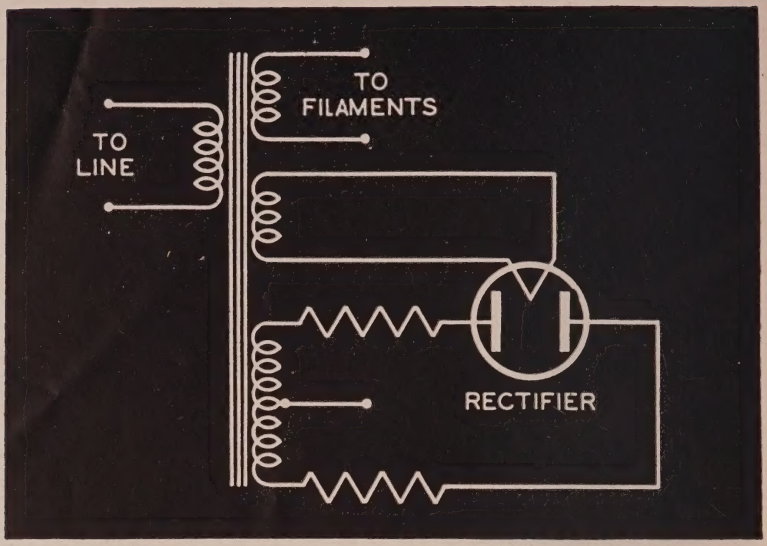



Fig. 2a. Method of reducing high voltage when substitute transformer delivers too much voltage.

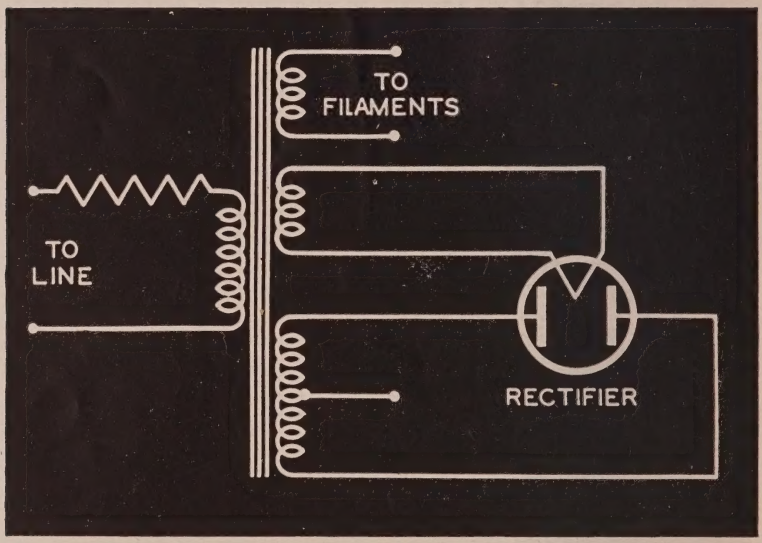



Fig. 2b. When all windings provide excess voltage, the primary input should be reduced by inserting a series resistor.

(Continued in next issue)

# THE RADIO TRADING POST

(Continued from page 4)

**WANTED** — All wave crystal receiving set, also Murdock loose coupler receiver. Give price and description. G. J. Gerhard, 1503 West 49th St. Los Angeles 37, Calif.

**FOR SALE** — Weston Model 280 Triple Range Voltmeter 3-30-150 v. Weston Model 280 Quadruple Range Ammeter 3, 15, 30, 150 amps. External 150 amp shunt. Both meters in good shape. $15 each. Louis M. Mendezoff, 5810 Pleasant Valley Rd., Cleveland 9, Ohio.

**WANTED** — Radio and technical books. State price and age of book. Cash or will trade photo equipment. Hansen Radio Service, 165 Silverbrook, Niles, Mich.

**FOR SALE** — 50 6B6 61c; 50 6V7G 72c; 50 41 38c; 40 6V6G 55c; 12 6F8G 55c. All tubes are new, not boxed. Special price if you can take all. Salbrook Radio, 3835 White Plains Ave., Bronx 67, New York.

**FOR SALE OR TRADE** — Tubes at OPA ceiling. 6 1LH4; 6 1T4; 2 7J7; 2 7L7; 4 43. All guaranteed new and in original cartons. Will swap for Riders manuals 7, 8, 9. Must be in first class condition. H & S Radio Service Box 345, Brevard, N. C.

**WANTED** — Portable radio or phonograph. Electric radio and combination phono. Have "A" and "B" batteries or what do you need. Rudy Cucciniello, 422 Crescent Ave., Chelsea, Mass.

**FOR SALE** — Automobile radio, Truetone, designed to fit any car. Has push buttons. Tubes and speakers and other parts. What have you? Rudy Cucciniello, 422 Crescent Ave., Chelsea, Mass.

**WILL SWAP** — PA system, 30 watt output, complete with tubes, less speakers. Want oscilloscope. Geo. C. Ellwood, 90 Ocean View Ave., Santa Cruz, Calif.

**FOR SALE** — 3" Jewell 0-50 ma. meter in excellent condition. Ship postpaid for $5.50. J. Goldstein, 151-09 34th Ave., Flushing, L. I., N. Y.

**FOR SALE** — Brewster FM converter, 8 tubes, fine condition. First $35 takes it, postpaid. Albert Rosen, 5650 Addison St., Philadelphia, Pa.

**FOR SALE** — .22 Winchester rifle, bolt action, single shot, with 9 boxes cartridges (50 to a box). $15. Albert Rosen, 5650 Addison St., Philadelphia, Pa.

**FOR SALE** — Supreme Model PB100 VOM, $30. Brand new. Louis Sandoz, 409 Gibbs Rd., Navy Point, Pensacola, Fla.

**FOR SALE** — New tubes in original cartons. Any quantity. Write for list. Hedrick Electric Co., Rockford, Ill.

**FOR SALE** — Riders Manuals, 1 to 13 incl., slightly used. Best offer takes one or all. Also Radio City Model 702 sig. gen, like new. F. Cristiano, 253 Halstead Ave., Harrison, N. Y.

**FOR SALE**—Class AB 2 push-pull parallel 6L6 amplifier, 50 watts output, two phono input, two mike inputs and one trumpet with 5" driver, excellent fidelity, $200. Glenn Riggs, 200 S. 1st St., St. Helens, Ore.

**FOR SALE** — Triplett 1503 multitester, good condition, make offer. 2 Astatic FP8 Xtal pickups, sapphire needle, $12.50 ea. Gordon dc phono motor, $15; rotary bench saw, $16. A. Gioia, 41-18 29th St., Long Island City 1, N. Y.

**FOR SALE** — Philco sig. gen., model 070, used very little. Want good VTVM and good condenser tester of bridge. Wilcox Radio Service, Water Valley, Miss.

**FOR SALE** — Late 1943 NRI course, 50 books, good condition, with radio dictionary. Will sell for $20 or trade for good tube checker. Mitchel Busly, Tahlequah, Okla.

**WANTED** — Good tube tester, Superior 1280 or similar. Robert Crotinger, 2909 N. Market, Wichita 4, Kan.

**WANTED** — March and April, 1945, issue of Radio and Television Retailing magazines. Will pay 50 cents each. Destroyed pages not accepted. Wm. Dressler, 2030 71st St., Brooklyn 4, N. Y.

**WANTED** — RCP meter to check volts, ac and dc, capacitance, resistance Louis Amarosa, 22-60 27th St., Astoria 5, L. I. C., N. Y.

**FOR SALE** — Majestic chassis and spkr, Models 300, 130, 50, 320, 90. RCA Radiola chassis and spkr. with tubes, model 46. Philco chassis and spkr., model 111. L. A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

**FOR SALE** — Have hard to get tubes. Orders filled as received. V. Kozma, 3104 Wilkinson Ave., N. Y. 61, N. Y.

**WANTED** — .1 tube testing transformer, 3 lead primary, 17 lead secondary. State price. J. Lagana, 2001 Morris Ave., Bronx 53, New York.

**FOR SALE** — Tubes, some 30% off list; Send for list. Also adapters at 50c each 14A7 to 12SK7 and 14J7 to 12SA7. Ralph Hunter, Catskill, N. Y.

**FOR SALE** — Radio City signal generator; Weston dc. panel meter; Readrite ac. panel meter; RCA oscillograph; Weston ac. panel meter; cutting arm assembly; experimental television set complete less cabinet. Want 8MM projector. R. H. Cherrill, 4235 E. Barnett St., Philadelphia 35, Pa.

**FOR SALE** — Interchangeable Radio Tube Manuals. List 100 substitutes for hard-to-get tubes. No rewiring necessary. Send 25c cash and 3c postage. Worden Radio Shop, 121 Maple St., Friend, Neb.

**SWAP** — New 813 or 100th for fresh water fishing tackle; boat or fly rod preferred. B. Jacobus, 484 Clifton Ave., Newark 4, N. J.

**SALE OR TRADE** — Astatic Model JT 30 microphone, RCA station allocator, Rickenbacher Electro Hawaiian guitar and amplifier, and new Utah PM 12" speaker with 46 oz. magnet. Need 1 volt and 25 volt tubes, also signal tracer. 1209 Admiral Dewey Ave., Pascagoula, Miss.

**FOR SALE** — 30-30 Winchester high power pump action rifle $30. Also 1929 Indian motorcycle $25. Will trade on radio equipment. P. N. Snyder, P. O. Box 320, Sunbury, Pa.

**WANTED** — Used tattooing machines. All makes and types. State quality and price. Snyder and Newbury Tattooing Corp., Box 321, Sunbury, Pa.

**SALE OR SWAP** — Philco Model "R" Series "B" tube tester with modernizer in perfect condition and RCA station allocator Model 171 for good sig. gen. Paul R. French, 128 Utah St., Baytown, Tex.

**SALE OR SWAP**—New Pioneer Genemotor; used Philco auto genemotor; used tubes; radio hardware and parts; transmission and aerial wire; Philco filter and bypass condensers in cans; power transformers, etc. What do you need? S. J. Shimshak, 13 Fulton Ave., Jersey City 5, N. J.

**FOR SALE** — Supreme 599 tube and set tester new, 37 new tubes, 12SQ7, 35L6, 12SK7, 12A6, 12SA7, and many others. Lot $80. Frank M. Pulson, 182 Cottage Park Road, Winthrop, Mass.

**WANTED** — Radio service neon sign, typewriter, Beitman Manuals, and parts. Have VR150 100-1000 KC crystal, etc. Painesville Radio Laboratory, 3 South State St., Painesville, Ohio.

**TRADE** — Older model Bausch & Lomb microscope, low and high power plus oil immersion, in excellent condition in case. Want 3" or 5" oscilloscope. State model. Capt. E. W. DeLong, 1600 S. Third St. Alhambra, Calif.

**WANTED** — Voltmeter or milliammeter. Send description and price. W. C. Ferguson, 1310½ 6th, Corpus Christi, Tex.

**WANTED** — Bakelite cabinet for Crosley 628. John Wohlrab, 37 Ardmore Place, Buffalo 13, N. Y.

**FOR SALE** — Philco 066 tube (Gm) tester. Checks voltage 3 ranges (10, 100, 1000) at 1000 ohms/E and ohms (0 to 500,000). Loctals need adapter. $25. R. Altomare, 10306 Colesville Rd., Silver Springs, Md.

**SALE OR TRADE**—Quantity of new tubes. Send for list. Want photo enlarger. Walter Hryniewicki, Thorp, Wis.

**SALE OR TRADE** — Various used tested tubes. What have you to trade? Roby's Swapmart, 820 E. 61st St., Chicago 37, Ill.

**SWAP** — Have deluxe wireless record player. Want 8 mm movie projector. W. M. McDonald, 33A North St., Stoneham 80, Mass.

**WILL SWAP**—Assorted parts for used but useful test equipment. Have 6L6, 27, 30, 42, 6F7, 80, 6SQ7, 7A4, 7B8, 39/44, 38, 6D6, 6C6, others. C. Shiffman, 80 Hazleton St., Mattapan 26, Mass.

**SALE OR SWAP** — Have portable radio with tubes and new unused batteries. Want phono recorder or 8 mm movie projector. W. M. McDonald, 33A North St., Stoneham 80, Mass.

**FOR SALE**—General Industries 12" dual speed turntable and Astatic S-12 crystal pickup $25.00. COD, FOB. Frank Dane, 3852 Eagle St., San Diego 3, California.

**WANTED**—A ¾-size aluminum bass violin in good shape. Will trade a new 30 to 35 watt 8 tube three channel amplifier with screen tubes, cables and one P.M. speaker, or will pay cash. Sound system value $150. John Arnold, P O Box 84, Bluffs, Illinois.

**WANTED**—1 or 2 P.M. speakers of 15 or 20 watts and 10 or 12 inch, also a dynamic microphone. New or used. Have radio parts of all kinds and cash. Have 5,000 hard to get new radio tubes, also large 15 in. dynamic speakers and transformers. John Arnold, P.O. Box 84, Bluffs, Illinois.

**FOR SALE**—H.R.O. receiver, Hallicrafters S-16 and G.E. E-126 12 tube chassis, and 12" speaker 550 kc to 70 mc. W. L. Thiel, 96 Westbury Blvd., Hempstead, N. Y.

**FOR SALE**—Stancor 60 P transmitter. 90 watts CW, 60 watts phone. Excellent condition. Complete. All coils included. $90.00. F. Hill, W20AV. 315 West Park Ave., Angola, Indiana.

**SWAP OR SELL**—G. I. heavy duty phono motor, 33 r.p.m. variable speed, 110 v., also 12 in. table for same. Interested in outdoor equipment, field glasses, binoculars. Guido Paolini, 88 South St., Westboro, Mass.

**FOR SALE**—Just arrived a complete shipment of hard to get radio tubes, such as 35Z3, 35Z4, 35Z5, 35L6, 1A7, 80, 12SA7, 12SK7, 12SQ7, 6A7, 6A8, 1R5, etc. Supply limited. Order filled as received. V. Kozma, 3104 Wilkinson Ave. 61, New York, N. Y.

**FOR SALE**—2 speed 12 in. G.E. turntable with Astatic model B-10 pickup, mounted, new condition, $25. Also RCA Junior crystal pickup (used) $3.50. New Univex 8 mm movie camera, model B-8, with two rolls No. 100 Ultrapan Film, $11. L. M. Munger, DeKalb, Ill.

**WANTED**—Late model tube tester, also accurate volt-ohmmeter, or combination tube and set tester. Price must be reasonable. John A. Makuta, Curtisville, Penna.

**FOR SALE**—Late Sprayberry radio course, complete, good condition. Make me an offer. Frank P. Martin, 1990 Ford Drive, Cleveland 6, Ohio.

**FOR SALE**—Four each CK501X, CK507AX, Five each CK502AX, 505AX, CK506AX, new Raytheon hearing aid tubes. Pigtail leads, no base, suitable for battery portables. Make me an offer. All replies answered. F. J. Connor, 3449 Thomas Ave., North Minneapolis 12, Minn.

**WANTED**—Riders Manuals, vols 8 to 13. Advise price and condition. One vol. or all wanted. Pacific Sales Corp., 426 Larkin St., San Francisco 2, Calif.

**FOR SALE** — Solar capacitor analyzer, model CE Exam-eter. Like new in condition and appearance. Sell for $44.00 cash. Remit by P.O. money order. Clyde W. Wimer, 800 Wampum Ave., Ellwood City, Pa.

**WANTED**—One 276A transmitting tube. I could also use a small thyatron tube such as the 2050 or the FG-17 and a couple of 866A half wave rectifiers. Abel Gomes, 8 Duke St., Ludlow, Mass.

**WANTED**—Riders 10-13, AC signal generator, 1" micrometer. Trade radio parts, light meter, camera, sporting goods, etc. List on request. W. J. Closson, 295—8th Street, Troy, N. Y.

**WANTED**—To buy for reasonable price a table radio such as Airline mod. No. 14 BR-521A, or similar make. Also one 12-SA7 tube and one 12SK7 tube. John L. Rhaton, Hill, Va.

**FOR SALE OR TRADE**—N.U. type 2031 Montron 3" picture tube. 5" photo-electric cell in case, 6" cathode ray tube. Wanted: FM tuner complete or kit. G. I. or New Products record-changer recorder. Tubes: 25D8, 25B8, 70L7, 12B8, 32L7. What have you to trade? All inquiries answered. F. U. Dillion, 1200 North Olive Drive, Hollywood 46, Calif.

**WANTED FOR CASH** — Portable recorder and play back, must be in excellent condition. We have for sale RCA Chanalyst in good condition. National Sound Equipment Co., 625 Main St., Worcester 8, Mass.

**FOR SALE**—R.C.P. No. 446 VOM, perfect condition, meter 6 months old, must sell at once, $15 cash. Send deposit, bal. COD. Pvt. S. Friedman, c/o David Friedman, 1759 W. 7th St., Brooklyn 23, N. Y.

**FOR SALE**—Brand new 12" PM spkr., cutting head, Dodge generators, etc. Send for list. Harry Kay, Rt. 2, Box 255, Imlay City, Mich.

**FOR SALE**—Westinghouse 0-1 m.a. (ac and dc) 3" sq. meter, new in carton, price $10.00. Weston 0-1 amp. dc 301 meter, cartoned, price $10.00. Also have portable radio with brand new batteries (in original cartons) price, $25.00. Gerald Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

**FOR SALE**—Assortment of 10 used meter tested 2 v. battery tubes for $3.90. Assortment of types must be left to us. Henshaw Radio Co., 3313 Delavan, Kansas City 2, Kansas.

**WANTED** — NRI booklet entitled "Radio Receiver Troubles, Their Cause and Remedy." Will give 50c cash or new $1.50 Pfanstiel permanent phono needle or 1N5GT tube. J. S. Jackson, 166 N. Sierra Bonita, Pasadena 4, California.

**SWAP OR SALE**—Power pack for radio builder or experimenter. 6.8 vdc to 160 vdc, also photo-electric equipment and radio course and manuals. Reed B. Gillette, RFD No. 1, Sharon, Conn.

**FOR SALE**—Six power transformers with attached vibrators for auto radios, also 2-speed phono motor, 12" turntable, Atwater Kent speaker 1¾" voice coil, 1200 ohm field. Will sell or trade, what have you? H. Hansen, 3942 24th St., San Francisco 14, Calif.

**FOR SALE**—Kolster K20 radios for PM spkrs., Colonial, mod. 38, Majestic table models 320 and 50. Philco, Majestic, RCA, Brunswick, Fada, Crosley radios also Kolster K5 model A power amplifier, brand new. Louis Goldstone, 1279 Sheridan Ave., Bronx 56, New York.

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